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Ronald C. Johnson argued that if early environmental stimulation or deprivation has a significant effect on intellectual ability, then individuals who are genetically identical and who are exposed to a common early environment should resemble one another more closely in IQ than similar individuals who have not shared a common environment. Johnson compared the IQ's of 23 pairs of twins separated at different times. He found that twins who were separated after they were 1 year old resembled one another significantly less closely than early separated twins. A Danish study of 12 pairs of Juel-Nielsen (1962) supported this result. A study by Shields in 1962 found no significant difference in the scores of 48 pairs of twins on (1) Raven's Dominoes Intelligence Test and (2) the synonyms part of the Mill Hill Vocabulary Scale, regardless of the age of the pair of separation. (WD)

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RESEARCH REPORT

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Further Evidence on the Relation Between Age of Separation and Similarity in IQ Among Pairs of Separated Identical Twins

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ABSTRACT

Two recent studies of separated identical twins allow a check of an earlier conclusion that members of early separated pairs of identical twins resemble one another more closely than do members of late separated pairs. One study, from which actual IQ scores are available (Juel-Nielson), supports this earlier conclusion; the other study (Shields), from which raw score differences on two tests are available, shows no significant relation between age of separation and similarity in test scores.

Johnson (1963) argued that "if early environmental stimulation or deprivation has a significant effect on the measured intellectual ability of humans, then individuals who are genetically identical and who are exposed to a common early environment and thus also have shared the amount of stimulation that this environment offered, should resemble one another more closely in tested IQ than individuals who are genetically identical but who have not shared a common environment for any appreciable period of time". Johnson then obtained, from the previously published literature, 11 pairs separated prior to 6 months of age (median age of separation = 1 month) and 12 pairs separated at one year or later (median age of separation = 18 months), and found that members of twin pairs in the late separation resembled one another significantly less closely than members of the twin pairs in the early separation group.

The publication recently of a Danish study of twins reared apart (Juel-Nielsen, 1962) provides an opportunity to check on this finding. Juel-Nielsen studied 12 pairs of identical twins who had been separated early in life. These twins were found by exhaustive search of the twins born between 1870 and 1910 registered at the Institute of Human Genetics in Copenhagen. Information from the twin registry was matched with data from the Danish census, the Folke-registry, to find all twins in this age range who had been reared apart. The zygocity of the twins was determined by a battery of blood group tests performed at the Institute

of Human Genetics in Copenhagen. Along with many other observations, IQ's were obtained on these twins; a Danish version of the WAIS was used. Table 1 shows the ages of separation and the IQ differences (along with the original source of the data) for Juel-Nielsen's 12 pairs, for the 23 pairs in the Johnson study, and for two pairs (Gates & Brash, 1941; Stephens & Thompson, 1943) that Johnson missed, with pairs divided into those separated before as opposed to at or after one year of age.

Table 1. Age at separation, source of data, and differences in I.Q. for 37 pairs of MZ twins from various studies. For abbreviations see key at bottom of table.

1 day	(S & T)	4			
1 day	(J-N)	6	1 yr.	(J-N)	9
9 days	(B)	1	1 yr.	(J-N)	14
1/2 mo.	(M)	4	1 yr.	(NFH)	19
3 wks.	(J-N)	1	1 yr.	(NFH)	5
3 wks.	(J-N)	1	1 yr.	(NFH)	1
1 mo.	(S)	4	14 mos.	(NFH)	4
1 mo.	(G & N)	3	18 mos.	(NFH)	12
1 mo.	(NFH)	1	18 mos.	(NFH)	12
1 mo.	(NFH)	6	18 mos.	(NFH)	24
1 mo.	(NFH)	1	18 mos.	(NFH)	7
6 wks.	(J-N)	11	2 yrs.	(NFH)	10
2 mos.	(NFH)	2	2-1/2 yrs.	(NFH)	2
3 mos.	(NFH)	15	3 yrs.	(NFH)	8
3 mos.	(G & B)	19			
5 mos.	(NFH)	17	3-1/2 yrs.	(J-N)	8
6 mos.	(NFH)	1	3-1/2 yrs.	(J-N)	6
7 mos.	(J-N)	4	5-3/4 yrs.	(J-N)	13
9 mos.	(J-N)	6	6 yrs.	(NFH)	9
10 mos.	(J-N)	3			

Key

J-N = Juel-Nielsen, 1964
B = Burks, 1942
M = Muller, 1925
S = Saudek, 1934
S & T = Stephens & Thompson, 1943
G & N = Gardner & Newman, 1940
G & B = Gates & Brash, 1941
NFH = Newman, Freeman, Holzinger, 1937

As was the case with those pairs in Johnson (1963), the Juel-Nielsen pairs separated after one year differ from one another significantly more than do pairs in the early separation group. A sum of ranks test (Walker & Lev, 1953) yields a z of 2.19, $p =< .04$. For all pairs shown in Table 1, a sum of ranks test yields a z of 3.98 showing pairs in the late group to differ from one another significantly more than do pairs in the early separation group. The early separation group differs by an average of 5.50 IQ points; the late separation group by 9.59 points. The mean within pair difference for the entire 37 pairs is 7.64 points.

Before we end, we want to call attention to the results from the study by Shields (1962) of identical twins raised apart, diagnosed by extensive bloodtyping. Shields did not determine an IQ. He used Raven's Dominoes Intelligence Test and the Synonyms part of the Mill Hill Vocabulary Scale and reported points of difference in the scores for 48 pairs, so that only differences between raw scores can be compared.

Table 2 shows these differences for three groups of MZ twins: 1. those separated at nine months of age and before, 2. those separated at one year of age or later, and 3. those separated at birth, but reunited at ages varying between 5 and 12 years, plus one pair separated at 9 months and reunited at 12 years. The mean and S.D. of test differences for these three groups are 8.81 and 6.89 (N = 19), 12.10 and 9.76 (N = 12) and 7.29 and 9.40 (N = 7). These means are not significantly different from one another. (A split between twins separated before or after 1 year did not give significance nor did a split before and after 6 months.)

Table 2. Age at separation and differences in scores on the Dominoes test for Identical Twins Raised Apart

(From Shields 1962)

Age at separation	Differences in test scores	Age at separation	Differences in test scores
Birth	3	12 mos.	2
"	3	12 mos.	12
"	3	16 mos.	5
"	6	20 mos.	23
"	7	22 mos.	30
"	8	24 mos.	8
"	8	30 mos.	14
"	10	48 mos.	10
"	16	48 mos.	24
"	17	84 mos.	1
"	20	96 mos.	5
1-1/2 mos.	22	108 mos.	1
3 mos.	0		
3 mos.	10		
3 mos.	23		
6 mos.	2		
6 mos.	5		
6 mos.	7		
9 mos.	1		

Age at separation	Age when reunited	Differences in test scores
Birth	5 yrs.	1
"	5 yrs.	4
"	9 yrs.	25
"	11 yrs.	6
"	12 yrs.	4
"	12 yrs.	6
9 mos.	12 yrs.	5

Like Johnson's data, these data do not suggest that a longer period of common early environment produces a greater similarity in IQ. Rather, as long as actual IQ scores are used, the reverse appears to be true. It should be noted that the chief finding is that a longer common

environment does not result in greater similarity between members of twin pairs, even though the negative obtained relation also appears deserving of consideration and, if possible, explanation. One possible explanation has been advanced by Daniel G. Freedman (1966). He noted that the major difference in Table 1 really is between those separated at or before one month as opposed to after one month. He argued that twins placed in separate families prior to one month of age must have been more strong and vigorous than is common among twin pairs and further, that they must both have been quite similar in this respect. Since it is common, in the case studies on separated identicals, to find very substantial differences in weight and in vigor between members of twin pairs, it may be that those twins separated at or prior to one month of age shared a much more equal intrauterine environment than twins in general which, in turn, resulted in their being more similar in IQ than other twin pairs.

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